David Mata

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Cc:	Yasurek, Ronald; Kane, Pat; Jellerson, David; Williams, Andrea; van der Voorn, Patrick; Bandyopadhyay, Subrata
Subject:	Mosaic Uncle Sam Stack Update Report
Attachments:	Figure 1 - North Perimeter Dike - 03-18-2019.pdf; Figure 2 - North Crest of Gypsum Dike - 03-18-2019.pdf; Figure 3 - North Perimeter Dike - 03-18-2019.pdf; Figure 4 - North Crest of Gypsum Dike - 03-18-2019.pdf; Figure 5 - Mid-North-Slope - 03-18-2019.pdf; Figure 6 - North Crest of Gypsum Dike Settlement- 03-18-2019.pdf; Mosaic Dike Monitoring 2019-03-18.xlsx; North Slope Inclinometer Location Plan-R4.pdf; SAA-6B-03-17-19 TO 03-18-19.xlsx; SAA-6B-03-18-19.xlsx; SAA-N1-03-17-19 TO 03-18-19.xlsx; SAA-N1-03-18-19.xlsx; SAA-N-03-17-19 TO 03-18-19.xlsx; SAA-N-03-18-19.xlsx; SAA-NE1-03-17-19 TO 03-18-19.xlsx; SAA-NE1-03-18-19.xlsx; SAA-NE-03-17-19 TO 03-18-19.xlsx; SAA-NE-03-18-19.xlsx; SAA-NW-03-17-19 TO 03-18-19.xlsx; SAA-NW-03-18-19.xlsx; Questions for Mosaic for 3-18-2019 PvdV.docx

Ladies and gentlemen,

This is Mosaic Fertilizer's daily update for Tuesday March 19, 2019 on activity related to the Stack 4 North Perimeter Dike.

Please note that Mosaic is supplementing yesterday's answers to the LDEQ's questions. These answers are found in today's attachments.

North Earthen Perimeter Dike

- The crest road and slopes of the north earthen perimeter dike were generally well-maintained and in good condition. The geotextile-reinforced gravel road surface was dry and well graded with no apparent signs of cracking or settlement.

- Water level in the Process Water Return Ditch was observed to be relatively low. No apparent signs of piping or settlement were observed on this ditch.

- Shrinkage cracks are observed on gypsum accumulated on the inboard face of the east side of the process water return ditch.

- Longitudinal cracks were observed on March 19, 2019 on the exposed gypsum beach inboard of the north gypsum perimeter dike. The cracks appear to be either shrinkage or differential settlement cracks which are expected to form as the water level drops in Stack No. 4 and the gypsum surface dries and desiccates. Observations will continue to be made during subsequent inspections to confirm that the cracks are from shrinkage and differential settlement, as expected, rather than associated with a potential slip surface.

- No apparent transverse cracks were observed at this location.

North Side Slopes

- The north lower and mid side slopes of Stack No. 4 were observed to be in generally good condition with no apparent signs of cracking or settlement.

- Longitudinal cracks are observed on gypsum benches located about 10 to 20 feet above the north interceptor ditch.

- Differential settlement cracks are observed at the northeast corner of the stack, in gypsum benches located above the interceptor ditch.

- No apparent transverse cracks were observed at this location.

Crest of Stack No. 4

- The crest of the north gypsum dike was observed to be in good condition, having crest widths between 30 to 45 feet with safety berms maintained along both the inboard and outboard edges.

- Longitudinal cracks are observed on the crest of the north gypsum dike, about 400 feet west of the northeast corner of the dike.

- Shrinkage cracks are observed on the last lift of uncompacted cast gypsum that was placed inboard of the north crest road prior to moving gypsum placement operations to the south area of Stack No. 4. Cracks are observed in the gypsum lift where a ditch was excavated in conjunction with gypsum disposal operations at that time (i.e., prior to moving gypsum placement operations to the south area).

- Shrinkage cracks are observed on the uncompacted cast gypsum safety berm located on the outboard edge of the crest road, about mid-way along the north wall crest. The shrinkage cracks do not extend to the outboard gypsum slope or to the inboard gypsum road.

- No apparent transverse cracks were observed at this location.

Surveying

- The accuracy of the RTK GPS systems used in the survey is ±0.36 to ±0.84 inches in the horizontal direction.

- Survey data indicates lateral movement in the stakes installed along the north perimeter dike at an average rate of about 0.44 inches per day since January 11, 2019 at the location with the highest total displacement (i.e., at Stake No. 141). The cumulative lateral movement since January 11, 2019 at the location with the highest total displacement is about 28.75 inches (i.e., at Stake No. 141). The apparent incremental lateral movement between March 17 and March 18, 2019 at this location is 0.06 inches. The average rate of movement at this location between March 12 and March 18, 2019 is 0.18 inches per day. Surveyed ground elevations at the stakes installed along the north perimeter dike indicate vertical differences that range from -0.7 to +4.1 inches between January

11 and March 18, 2019. The following table summarizes the maximum and daily incremental displacement of the stakes located in the area with the highest lateral movement.

Earthen Perimeter Dike Survey Stake No.	Max. Displacement (inch)	Incremental Displacement (inch/day)
138	25.66	-0.08
139	27.66	0.24
140	28.64	0.19
141	28.75	0.06
142	28.28	0.17
143	28.65	0.03
144	28.00	0.27
145	27.32	-0.03
146	26.85	0.26
147	26.03	-0.20
148	26.10	0.13
Average	27.45	0.10

- The survey data indicate lateral movement in the stakes installed along the crest of the north gypsum dike at an average rate of about 0.31 inches per day since January 11, 2019 at the location with the highest total displacement (i.e., at Stake No. 217). The cumulative lateral movement since January 11, 2019 at the location with the highest total displacement is about 20.38 inches (i.e., at Stake No. 217). The apparent incremental lateral movement between March 17 and March 18, 2019 at this location is 0.62 inches. The average rate of movement at this location between March 12 and March 18, 2019 is 0.26 inches per day. Surveyed elevations at the stakes installed along the crest of the north gypsum dike indicate settlement ranging from about 16.0 to about 40.0 inches between January 11 and March 18, 2019 (i.e., settlement rate ranging from 0.24 to 0.61 inches per day). The following table summarizes the maximum and daily incremental displacement of the stakes located in the area with the highest lateral movement.

Gypsum Dike Survey Stake No.	Max. Displacement (inch)	Incremental Displacement (inch/day)
216	19.48	0.39
217	20.38	0.62
218	20.26	0.51
219	19.51	0.59
220	19.77	0.20
221	19.06	0.28
222	18.57	0.10

Average	19.57	0.38

- Survey data indicate lateral movement in the stakes installed along the mid-slope of the north wall at an average rate of 0.50 inches per day since January 28, 2019 at the location with the highest total displacement (i.e., at Stake No. 718). The cumulative lateral movement since January 28, 2019 at the location with the highest total displacement is about 24.50 inches (i.e., at Stake No. 718). The apparent incremental lateral movement between March 17 and March 18, 2019 at this location is 0.07 inches. The average rate of movement at this location between March 12 and March 18, 2019 is 0.44 inches per day. Surveyed elevations at the stakes installed along the mid-slope of the north wall indicate vertical differences that range from -1.1 to +0.6 inches between January 28 and March 18, 2019. The following table summarizes the maximum and daily incremental displacement of the stakes located in the area with the highest lateral movement.

Mid-Slope Survey Stake No.	Max. Displacement (inch)	Incremental Displacement (inch/day)
713	23.40	-0.01
714	23.49	0.05
715	24.35	0.17
716	24.09	0.12
717	24.36	0.39
718	24.50	0.07
719	24.06	0.28
720	24.32	0.31
721	23.37	-0.01
722	22.98	0.27
Average	23.95	0.19

- Survey data indicate no apparent lateral movement in the stakes installed along the west and east perimeter dikes between January 18 and March 18, 2019.

- Survey data indicate an apparent lateral movement in the southwest direction in the stakes installed along the crest of the east gypsum dike between January 21 and March 18, 2019 ranging from about 1.27 to 1.87 inches (i.e., a rate ranging from about 0.02 to 0.03 in/day).

- Survey data indicate an apparent lateral movement in the following stakes installed along the crest of the west gypsum dike between January 21 and March 18, 2019: (i) in the north direction at Stake No. 609 of about 1.40 inches (i.e., a rate of about 0.03 in/day); and (ii) in the east direction at Stake Nos. 606 through 608 ranging from about 1.12 to 1.67 inches (i.e., a rate ranging from about 0.02 to 0.03 in/day).

- Surveyed ground elevations at the stakes installed along the west perimeter dike indicate vertical differences that range from -0.3 to +0.4 inches between January 18 and March 18, 2019.

- Surveyed ground elevations at the stakes installed along the east perimeter dike indicate vertical differences that range from -0.6 to -0.1 inches between January 18 and March 18, 2019.

- Surveyed ground elevations at the stakes installed along the crest of the west gypsum dike indicate settlement ranging from about 9.3 to about 14.9 inches between January 21 and March 18, 2019 (i.e., settlement rate ranging from 0.17 to 0.27 inches per day).

- Surveyed ground elevations at the stakes installed along the crest of the east gypsum dike indicate settlement ranging from about 12.0 to about 13.2 inches between January 21 and March 18, 2019 (i.e., settlement rate ranging from 0.21 to 0.24 inches per day).

Instrumentation

- Readings at the SAA displacement sensor installed at the mid-north-slope of Stack No. 4 (i.e., SAA-N replacement of inclinometer casing SI-N2) indicate a lateral displacement rate of about 0.52 inches per day at about elevation -95 feet (MSL) between February 8 and March 18, 2019.

- Readings at the SAA displacement sensor installed on the north earthen perimeter dike (i.e., SAA-N1 replacement of inclinometer casing SI-N1) indicate a lateral displacement rate of about 0.14 inches per day at about elevation -70 feet (MSL) between March 6 and March 18, 2019.

- Readings at the SAA displacement sensor installed at the west side of the mid-north slope (i.e., SAA-6B replacement of inclinometer casing SI-6B) indicate an apparent lateral displacement rate of about 0.13 inches per day at about elevation -69 feet (MSL) between March 14 and March 18, 2019.

- Readings at the SAA displacement sensor installed at the west side of the north lower slope (i.e., SAA-NW) indicate a lateral displacement rate of about 0.13 inches per day at about elevation -76 feet (MSL) between January 31 and March 18, 2019.

- Readings at the SAA displacement sensor installed at the east side of the north lower slope (i.e., SAA-NE) indicate an apparent average lateral displacement rate of about 0.13 inches per day at about elevation -73 feet (MSL) between February 4 and March 18, 2019.

- Readings at SAA displacement sensor SAA-NE1 installed about 50 feet west of SAA-NE located at the east side of the north lower slope indicate an apparent lateral displacement rate of about 0.13 inches per day at about elevation -72 feet (MSL) between March 14 and March 18, 2019.

Water Management:

- Pond 4 Water El. 179.9 ft.
- Continued transferring water from the 110 Acre reservoir to the east cell
- Continued dike establishment / beaching in the west cell
- Continued decanting from the expansion area for plant operations
- Uncle Sam Gyp stack received an average of 0.00 inches of rain from 4:00 am Mar. 18 to 4:00 am Mar. 19

Pond	Approx. Current Volume (MMGal)	Approx. Remaining Capacity (MMGal)	Rainfall	
			Gauges	Inches
Pond 4	402.1	2.9	UIC	0.00
West Cell (Phase 1)	149.4	22.7	Dunn's Dam	0.00
Surge Pond	25.9	9.0	NE Corner	0.00
Return Ditch	9.8	2.1	004 Pumps	0.00
110 Acre Reservoir	339.3	28.7	**UIC Injection**	
East Cell (Phase 2)	109.1	373.8	Daily	1,288,353
Updated:	**3/19/19 4:00 AM**		MTD	26,310,998
Note: Water transfer from Pond 4 to East Cell started 3/7/2019 Water transfer from Pond 4 to East Cell suspended 3/15/2019 at El. 179.9 ft.				

Survey data is included in the attachments.
Figures indicating survey stake movement are included in the attachments.
Locations of inclinometers and inclinometer data is included in the attachments

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